

What is claimed is:

1. A voltage multiplier comprising:
a first stage having an input to receive an input voltage, the first stage
5 capable of multiplying the input voltage by a first amount to produce a first stage
output voltage; and
a second stage in series with the first stage, the second stage having an
input to receive the first stage output voltage, the second stage capable of
multiplying the first stage output voltage by a second amount to produce a
10 second stage output voltage.
2. The voltage multiplier as defined by claim 1 wherein the first amount and
second amount equals about 2.0, the voltage multiplier being a capacitive voltage
multiplier.
- 15 3. The voltage multiplier as defined by claim 1 wherein the first stage has a
first capacitance and the second stage has a second capacitance, further wherein
the second stage has an output capacitance, the output capacitance being
periodically charged to the second stage output voltage about twenty-five
20 percent of the total time that the voltage multiplier is operating.
4. The voltage multiplier as defined by claim 3 wherein the first stage has a
first associated switching speed and the second stage has a second associated
switching speed, the first switching speed being a function of the second
25 switching speed.
5. The voltage multiplier as defined by claim 4 wherein the first switching
speed is one of twice or half the speed of the second switching speed.

6. The voltage multiplier as defined by claim 1 further comprising a plurality of additional series stages coupled in series to the second stage, the plurality of additional stages having a final stage for producing a final output voltage, the
5 final output voltage being the product of the input voltage and 2.0 to the Nth power plus or minus a tolerance of about twenty percent, where N equals the total number of stages, the total number of stages including the first stage, second stage, and plurality of additional stages.
- 10 7. The voltage multiplier as defined by claim 6 wherein each of the first, second and plurality of additional stages has a capacitor that is switched between different nodes based upon a base frequency, the switching frequency of each stage being one of double or half that of the immediately preceding stage.
- 15 8. The voltage multiplier as defined by claim 6 wherein at least one of the stages has an output capacitor to provide an output voltage for that stage, the output voltage of that stage being greater than that of the output voltage of each preceding stage.
- 20 9. A method of multiplying an input voltage, the method comprising:
coupling a first capacitance to the input voltage, this coupling causing the voltage of the first capacitance be substantially equal to the input voltage;
coupling the first capacitance with a second capacitance in a manner that charges the second capacitance to a second voltage, the second voltage being
25 substantially equal to the sum of the input voltage and the voltage of the first capacitance; and

switching the second capacitance to an output node, the output node having an output voltage substantially equal to the sum of the input voltage and the voltages across the first and second capacitances.

- 5 10. The method as defined by claim 9 further comprising:
 uncoupling the first and second capacitances to permit the first
 capacitance to recharge to a voltage that is substantially equal to the input
 voltage; and
 re-coupling the first and second capacitances to produce the output
10 voltage.
11. The method as defined by claim 9 further comprising:
 coupling an output capacitance to the output node.
- 15 12. The method as defined by claim 9 wherein coupling the first capacitance
 with the second capacitance comprises coupling the first capacitance in series
 with the second capacitance to produce a series pair, the series pair being
 coupled between the input voltage and ground.
- 20 13. The method as defined by claim 9 wherein the output voltage is about
 four times greater than the input voltage.
14. The method as defined by claim 9 wherein the first capacitance has a first
 switching frequency and the second capacitance has a second switching
25 frequency, the first switching frequency being one of double or half that of the
 second switching frequency.
15. A voltage multiplier comprising:

first multiplying means having means for receiving an input voltage, the first multiplying means being capable of multiplying the input voltage by a first amount to produce a first output voltage; and

second multiplying means in series with the first multiplying means, the
5 second multiplying means having means for receiving the first output voltage, the second multiplying means capable of multiplying the first output voltage by a second amount to produce a second output voltage.

16. The voltage multiplier as defined by claim 15 wherein the first amount
10 and second amount equals about 2.0.

17. The voltage multiplier as defined by claim 15 wherein the first
multiplying means has a first capacitance means and the second multiplying
means has a second capacitance means, further wherein the second multiplying
15 means has an output capacitance means, the output capacitance means being periodically charged to the second output voltage about twenty-five percent of the total time that the voltage multiplier is operating.

18. The voltage multiplier as defined by claim 15 wherein the first
20 multiplying means has a first associated switching speed and the second multiplying means has a second associated switching speed, the first switching speed being one of twice or half the speed of the second switching speed.

19. The voltage multiplier as defined by claim 15 further comprising a
25 plurality of additional multiplying means coupled in series to the second multiplying means, the plurality of additional multiplying means having a final stage for producing a final output voltage, the final output voltage being substantially equal to the product of the input voltage and 2.0 to the Nth power,

where N equals the total number of multiplying means, the total number of multiplying means including the first multiplying means, second multiplying means, and plurality of additional multiplying means.

- 5 20. The voltage multiplier as defined by claim 19 wherein each of the first, second and plurality of additional multiplying means has a capacitor that is switched between different nodes based upon a base frequency, the switching frequency of each stage being one of double or half that of the immediately preceding stage.